A unique high resolution record of climate and vegetation changes during the EOT. The CDB1 core, Rennes Basin, France. Climate and Biotic Events of the Paleogene

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A unique high resolution lacustrine record of climate and vegetation changes during the EOT. The CDB1 core, Rennes Basin, France

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The transition between Eocene and Oligocene (EOT) is known as one of the major climatic change of the Paleogene. This climatic transition is marked by the change from a greenhouse to an icehouse climatic mode. Although the effect of climate change on terrestrial setting correspond to major changes in plant and animal communities (the well-known "Grande Coupure", Stehlin, 1910), most of studies are realized on marine successions in which several side-effects were identified (stepwise cooling, faunistic turnover, deepening of the CCD, eg. Coxall et al., 2005). Although more sensitive to climate changes, terrestrial settings suffer from the lack of continuous and well calibrated sections. Recently, the BRGM (French Geological Survey) has conducted a fully-cored deep drilling (CDB1) in the Cenozoic Rennes Basin. A continuous organic matter and clay rich lacustrine record encompasses the EOT as shown by palynology (Bauer et al., in prep.) and confirmed by magnetostratigraphy (Dupont-Nivet et al., 2013).

In order to decipher the climatic evolution during the EOT and its impacts on ecosystems, we have performed a full palynological study accompanied by the analysis of molecular biomarkers and of their isotopic composition. After extraction and separation of lipids, quantification of branched Glycerol Dialkyl Glycerol Tetraethers (GDGTs) was achieved by liquid chromatography coupled to mass spectrometry, whereas other lipids were identified and quantified by gas chromatography coupled to mass spectrometry. Additionally, the δD of vascular plants leaf-wax *n*-alkanes (with 27, 29 and 31 carbon atoms) was determined by gas chromatography coupled to isotope ratio mass spectrometry.

Indices calculated from branched GDGT concentrations in 50 samples allowed us estimating the evolution of mean annual air temperature based on two calibrations developed in recent soils (Peterse et al., 2012 and Weijers et al., 2007).

The paleohydrological reconstruction relies on the δD of *n*-alkanes determined for 50 samples and on their Average Chain Length (ACL, Eglinton and Hamilton, 1967). δD of *n*-alkanes depend on hydrological parameters such as temperature at precipitation site precipitation amount and evapotranspiration (Gleixner and Mügler, 2007; Sachse et al., 2006). ACL is used to decipher vascular plant adaptation to relative humidity: the longer the chain, the better vascular plants are adapted to dry conditions.

The two temperature records obtained from GDGTs show the same evolution, marked by two cooling trends: one during the late Early Priabonian and a second during the Early Rupelian. Conversely, two warming intervals are observed during the Early Priabonian and the Late Priabonian (EOT).

The ACL values vary between 26 and 28. From the Late Priabonian and the Early Rupelian, recurrent ACL variations attest to changes in relative humidity. One of these variations occurs during the EOT and shows the transition from humid to dry conditions. This interpretation is supported by the most negative *n*-alkanes δD values recorded during the Late Priabonian to the Early Rupelian that either indicate high precipitation rates, lower evaporation rates. Then, and as for ACL, δD values increase after the EOT, indicating the sudden settlement of dryer conditions.

How did these climatic changes impact the environment, and especially the vegetation? The evolution of vegetation is unraveled through specific biomarkers of ferns (fernenes), gymnosperms (diterpenes) and angiosperms (triterpenes ketones) and compared to spores and pollen data. From the Late Eocene to the Early Oligocene, spores and pollen counts delineate an increase in mesothermal species compared to megathermal species.

In detail, we observe an increase in coniferous species from the Late Priabonian to the Rupelian that is classically interpreted as the result of the installation of a cool and dry climate. These evolutions are in agreement with temperature evolutions deduced from branched GDGTs and also with the global cooling that is characteristic for this transition. However, diterpenes evolution is different from that of gymnosperm pollen since they are as abundant during the Eocene as during as in the Oligocene, except for a peak of concentrations recorded the early Late Priabonian.

As for gymnosperms, fern and angiosperm biomarkers do not show any global trend in concentration but high frequency changes from the Late Eocene to the Early Oligocene. Remarkably, these high frequency changes in vascular plants are consistent with the rhythm of ACL values. Thus, the evolution of continental ecosystems during the Priabonian and Rupelian appears paced by changes in relative humidity.

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